Introduction to the Policy Analysis Modeling System (PAMS) and Case Study

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Outline

1. Use of PAMS
2. Policy scenario(s)
3. Methodology
4. Inputs needed and potential data sources
5. Case Study

Use of PAMS

Policy Analysis Modeling System PAMS was developed by CLASP and Lawrence Berkeley National Laboratory (LBNL) to help local policymakers assess the benefit of standards and labeling programs, and it is available at clasponline.org

- Excel workbook
- Bottom-up approach

A. **The Consumer Perspective** examines costs and benefits from the perspective of the individual household
B. **The National Perspective** projects the total national costs and benefits including both financial benefits, energy savings and environmental benefits.

Use of PAMS

Used to estimate savings potential from implementing policies that improve the energy efficiency of new products in any economy

At the **National Level**:

- Energy savings – lower electricity consumption due to the market introduction of more efficient appliances
- Environmental Impacts - carbon dioxide emissions mitigation due to reduced electricity consumption

At the **Consumer level**:

- Energy bill savings – reduced energy bills for users due to lower electricity consumption

Policy scenario(s)

Policies implemented in 2020, impacts estimated through 2030:

- Base case → no policies requiring improvements made to the appliances

- Policy case 1 → Design 1 a specific efficiency improvement
- Policy case 2 → Design 2 a specific efficiency improvement
- Policy case 3 → Design 3 a specific efficiency improvement

Results: a comparison between the policy and the base case

Methodology

PAMS methodology for stock and sales forecasting:

- Ownership levels are based on a diffusion model based on:
  - household income
  - electrification,
  - urbanization, and
  - a climate variable for air conditioners

- Sales forecast considers:
  - First purchase (increase in number of households and ownership levels)
  - Replacement of retired appliances

Inputs needed and potential data sources

Product data
- Lifetime
- Baseline Price $
- Baseline Unit Energy Consumption

→
- National market assessments
- Local manufacturers / importers
- Industry associations

Country data
- Electricity price ($/kWh)
- CO2 emissions factor
- Transmission & distribution losses
- Consumer discount rate

→
- Normally provided by Ministry of Energy, Environment or other relevant agency

Efficiency data
- Efficiency design options and cost of efficiency

→
Technical reports that support regulatory processes:
- EU preparatory studies
- US DOE rulemakings
- Other countries' regulatory analysis

Case Study

Technical Assistance provided to CONUEE in the Elaboration and Revision of MEPS

Revision of the Mexican standards of refrigerators/freezers and room air conditioners and their possible alignment with new US DOE rulemaking

- Impact assessments were developed using PAMS and included:
  - A market analysis
  - A cost-benefit analysis
  - Summary of national impacts: energy savings and GHG emissions mitigation

MEPS revision for Room Air Conditioners (RACs)

Alignment between Mexican NORMS (MEPS) and the US DOE is preferred when possible

MEPS in Mexico:

- 1st standard NOM-073-SCFI-1994
- Revision NOM-021-ENER/SCFI/ECOL-2000
- Revision NOM-021-ENER/SCFI-2008

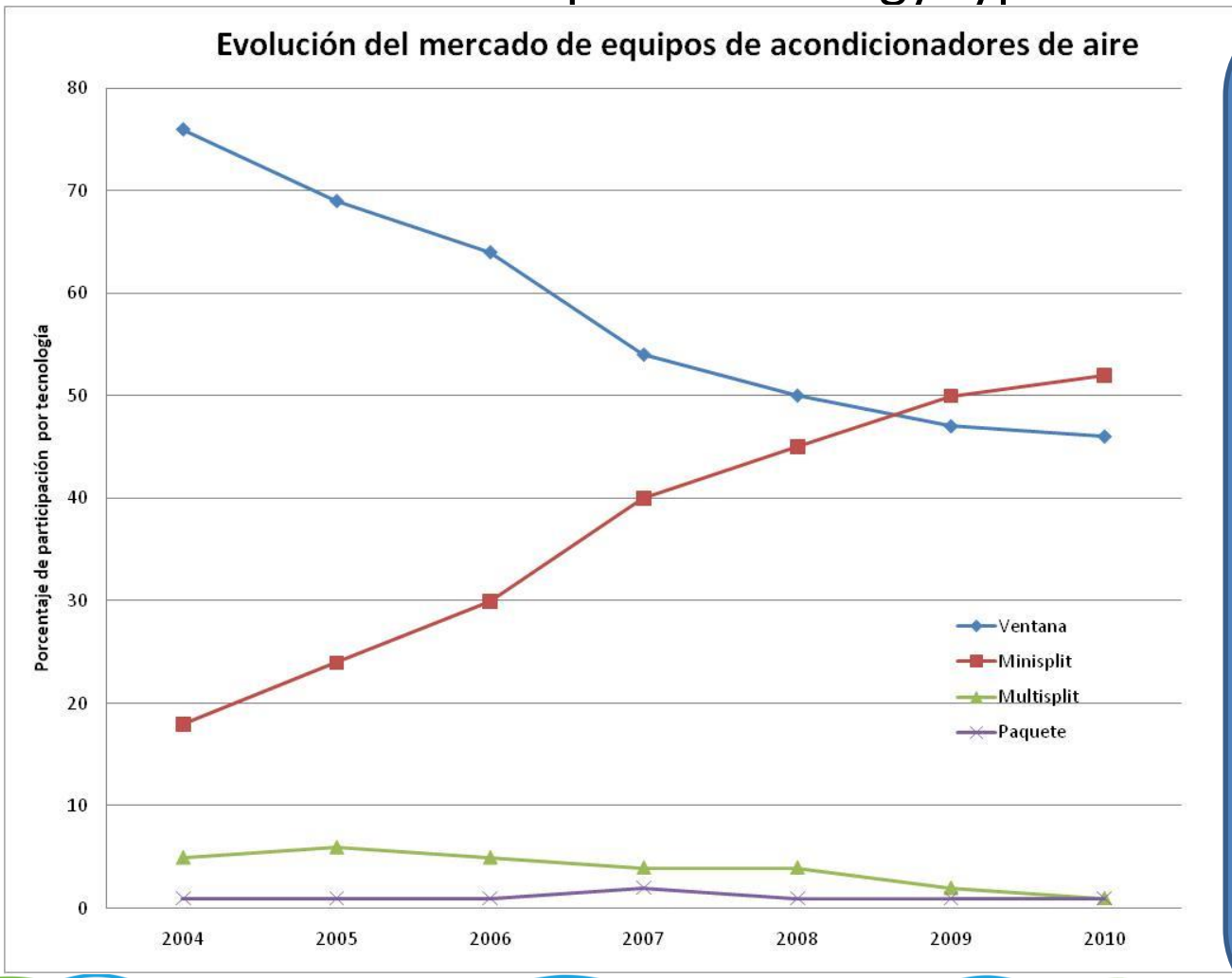
Last revision from US DOE:

- *Direct Final Rule* published in 2011 to be implemented in 2014

The analysis presented the regulatory impact assessment of revising MEPS levels in Mexico to those proposed in the US DOE rulemaking

Market Analysis

RACs market share per technology type



- RACs are mostly used in hot and dry areas in the north, and hot and humid areas in the south
- RACs use has increased in recent years due to warmer weather
- For consumers, energy costs related to the use of RACs represent up to 20% of household income
- For utilities, RACs use pressures system growth due to increased demand during peak loads
- RACs ownership ~ 20%

Market Analysis

Table 1: RACs market share per cooling capacity

Cooling capacity		Number of units 2008	Market share [%]
Thermal kW	BTU/h		
< 1.758	3400 – 5999	73,500	14.7
1.759 - 2.343	6000 – 7999	56,500	11.3
2.344 - 4.101	8000 – 13999	194,500	38.8
4.102 - 5.859	14000 – 19999	120,500	24.1
5.860 - 10.548	20000 – 36000	55,000	11.1
	Total	500,000	100.0

Table 2: Efficiency levels

		Energy efficiency Ratio (EER) (Wt/We)						
	CC (W)	2004	2005	2006	2007	2008	2009	2010
Class 1	1759	2.90	2.93	2.84	2.87	2.86	2.87	2.90
Classes 2-3-4	3518	2.95	2.99	2.93	2.97	3.05	3.1	3.02
Class 5	5861	2.64	2.67	2.64	2.68	2.71	2.67	2.68

Hours of operation: 8-12 h/day

Cost-benefit analysis

Develops an impact assessment to the consumer by providing answers to the following questions:

- Will the revised MEPS result in a net financial benefit or net financial cost to the consumer?
- Which of the proposed energy efficiency levels results in maximum net financial benefit?
- What are the net financial impacts to a consumer of harmonizing MEPS with the US DOE?

Costs and benefits from the consumer perspective use a ***Life-Cycle Cost*** (LCC) calculation

Cost-benefit analysis

PAMS calculates the LCC for two cases:

- Baseline: the case where no improvements are made to the appliance
- Policy case: a specific efficiency improvement is made to an appliance

The LCC calculation demonstrates how:

- increases in efficiency may increase the purchase price of an appliance for a consumer, and
- the energy savings can result in reduced energy expenses

Cost-benefit analysis

RESULTS:

LCC for RACs Class 1

	Class 1				
	EER	Incremental cost	UEC	LCC	ΔLCC
	W/W	MX$	kWh	MX$	MX$
Base case	2.89		1332	$14,021	
Option 1	2.96	$126	1301	$13,759	$(262)
Option 2	3.11	$293	1211	$13,259	$(762)
Option 3	**3.25**	**$528**	**1077**	**$12,836**	**$(1,185)**
Option 4	3.34	$754	933	$12,651	$(1,370)
Option 5	3.42	$ 1,541	789	$12,701	$(1,320)

Option 3 corresponds to the proposed level by US DOE.

Options 1 to 5 always result in net financial benefits for the consumer.

Cost-benefit analysis

PAMS also calculates the payback period: *the period of time required for the return on an investment to "repay" the sum of the original investment*

	Class 1	
	EER	PP
	W/W	years
Base case	2.89	
Option 1	2.96	0.6
Option 2	3.11	0.9
Option 3	3.25	1.1
Option 4	3.34	1.4
Option 5	3.42	2.6

In this case, the payback period is always less than half of the equipment lifetime
(average lifetime = 10.5 y)

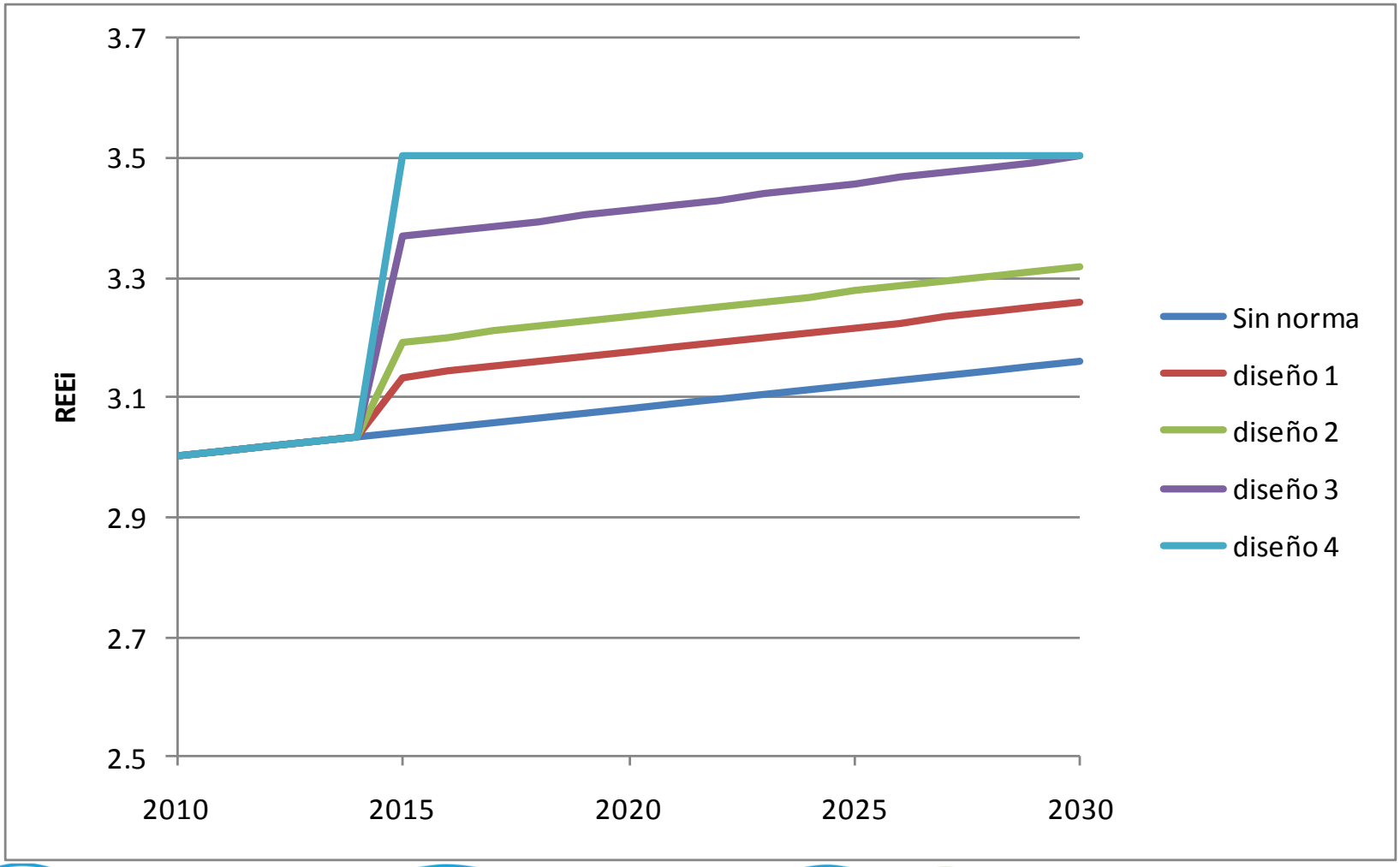
Very good!!

National impacts

- Energy savings – lower electricity consumption due to the market introduction of more efficient air conditioners
- Net Present Value - Net financial savings due to the lower electric bill (and the higher cost of equipment), discounted at the current year
- Environmental Impacts - carbon dioxide emissions mitigation due to reduced electricity consumption
- Avoided Generation Capacity – Reduction of peak demand and the need to implement new power plants

National impacts

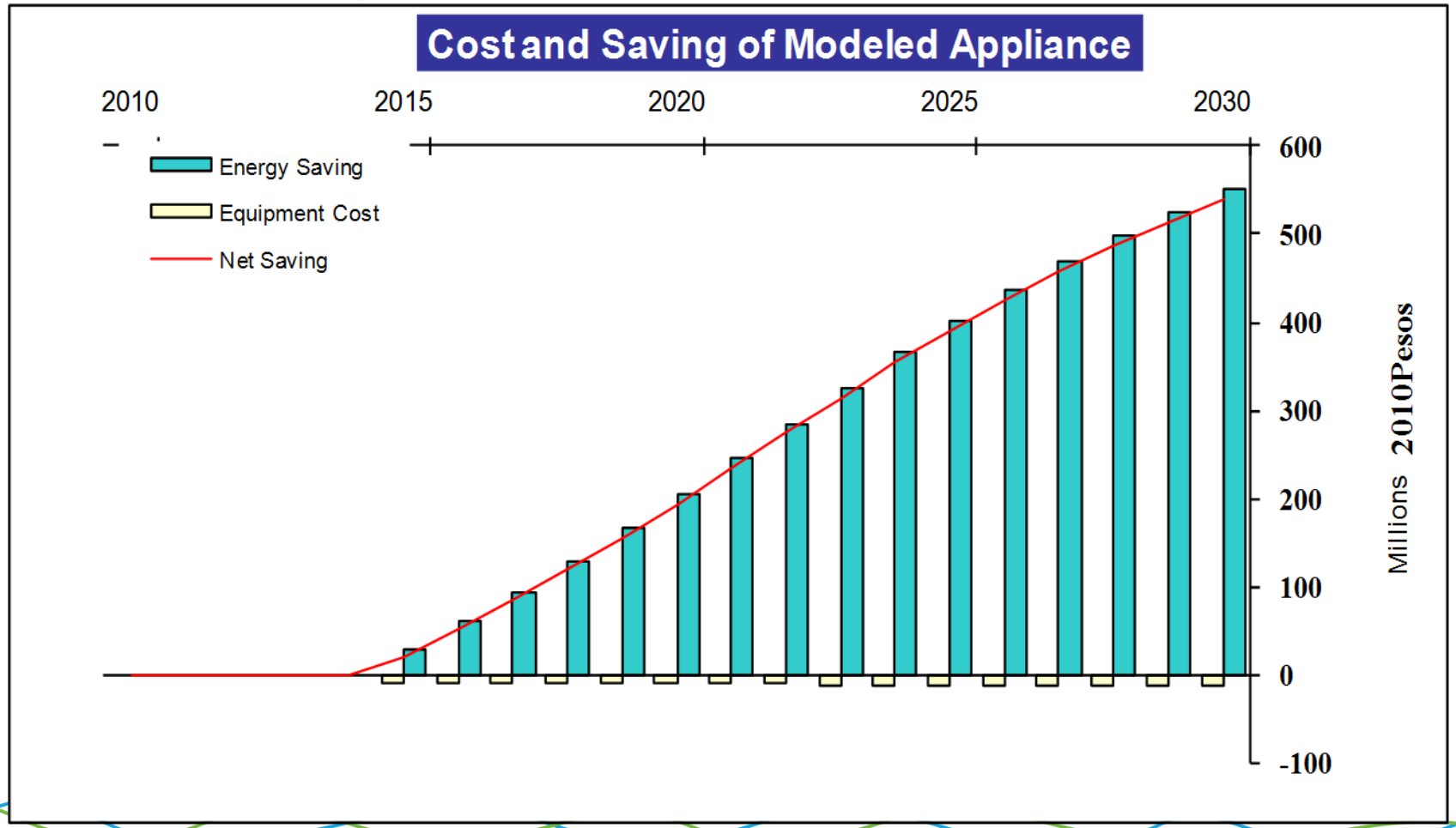
- Efficiency trends – Class 3 policy case



National impacts

RESULTS:

Cost and savings for Class 1



National impacts

RESULTS:

Energy and economic impacts at a national level

	Class 1							
	EER	Site NES 2030 (cumulative)	Source NES 2030 (cumulative)	Equipment cost (national)	Energy Savings	NPV	Cumulative CO2 emissions in 2030	Avoided generation capacity
	W/W	GWh	Mtoe	millions MX$	millions MX$	millions MX$	Mt	MW
Base case	2.89							
Option 1	2.96	261	0.054	$ 12	$ 719	$ 707	0.2	15
Option 2	3.11	785	0.162	$ 50	$2,159	$ 2,109	0.6	46
Option 3	**3.25**	**1,262**	**0.261**	**$105**	**$3,470**	**$ 3,366**	**1.0**	**74**
Option 4	3.34	1,515	0.313	$157	$4,166	$ 4,009	1.2	88
Option 5	3.42	1,752	0.362	$339	$4,818	$ 4,479	1.4	102

National impacts

RESULTS:

Three scenarios were analyzed for each product class:

- S1 – Alignment of Mexican MEPS with US DOE
- S2 – A scenario of maximum profitability of MEPS levels for each product class
- S3 – A scenario with maximum energy savings without penalizing the consumer

	S1		S2		S3	
Product Class	EER (W/W)	LCC savings (US DOE level)	EER (W/W)	LCC savings (maximum financial benefits)	EER (W/W)	LCC savings (maximum energy savings)
1	3.25	$ 1,185	3.42	$ 1,320	3.42	$ 1,320
3	3.19	$967	3.51	$ 1,739	3.51	$ 1,739
5	2.75	$ 1,109	2.87	$ 2,663	2.98	$ 1,674

National impacts

RESULTS:

- The analysis shows that aligning Mexican MEPS with US DOE will be profitable for the consumer for all product classes

- It also shows that there are MEPS levels more profitable than those aligned to US DOE.

- For classes 1 and 3, the max. tech. level gives maximum benefit to consumers; for class 5, a level 4% below the max. tech does.

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Thank you!